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09/818,427	08/23/2001	Ali Bani-Hashemi	2001 P 05443 US	1376

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Siemens Corporation
Intellectual Property Department
186 Wood Avenue South
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EXAMINER	
BRIER, JEFFERY A	

ART UNIT	PAPER NUMBER
2672	10

DATE MAILED: 03/26/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/818,427	Applicant(s) BANI-HASHEMI ET AL.	
	Examiner Jeffery A Brier	Art Unit 2672	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-41* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7, 10-13, 16-27, 35, 40 and 41* is/are rejected.

7)☒ Claim(s) *8,9,14,15,28-34 and 36-39* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 August 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. Figure 1 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description:

Fig. 11C, see page 9 line 25; and

Figure 12 120 is not shown as described at page 10 line 5 and page 39 line 20.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

3. The drawings are objected to because:

In figure 27 block 2706 line 3 "he" should be "the"; and

Figure 23 block 2308 lines 4-5 "th irtual" should be "the virtual" and at block 2318 "sight o the" should be "sight of the". A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

4. The disclosure is objected to because of the following informalities:

page 54 line 8 "he" should be "the".

Appropriate correction is required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-6, 10-12, 23-27, 35, 40, and 41 are rejected under 35 U.S.C. 102(b) as being anticipated by Navab, U.S. Patent No. 6,028,912.

The Navab patent teaches using a fluoroscope to analyze a patient and the orientation of a biopsy needle and the system displays on a display an image of a portion of the patient's body having the target tumer, a target T identified by the surgeon, and a virtual extension of the needle, see column 6 lines 21-30.

A detailed analysis of the claims follows.

Claim 1:

Navab teaches a method for augmented reality guided instrument positioning (*column 1 lines 5-11 and column 4 lines 33-64*) comprising the steps of: establishing a viewpoint (*the surgeon establishes a viewpoint that will lead to the target point T*), from which a line of sight to a point on a target (*target point T*) defines a path (*from the surgeons viewpoint to target point T*) for an instrument (*needle*) to follow during a positioning (*as the surgeon adjusts the angle of the needle the displayed virtual line moves so the surgeon can move the needle until the virtual line intersects the target point T, column 4 lines 33-64 and column 6 lines 21-30, also in the automatic mode the system determines the alignment of the needle*) of the instrument (*needle*) to the point on the target (*target point T*); and aligning the instrument along the line of sight to the point on the target (*the surgeon adjusts the angle of the needle until the needle is aligned such that its line of sight is to the target point T in the manual mode or if in the automatic mode the system aligns the needle, see column 11 line 24+*).

Claim 2:

Navab teaches the method according to claim 1, further comprising the step of moving the instrument along the path towards the point on the target, subsequent to said aligning step (*after the surgeon or the system has aligned the*

needle the system moves the needle towards the target T).

Claim 3:

Navab teaches the method according to claim 1, further comprising the step of rendering the target as a graphics object (*the target is illustrated on the display with computer generated graphical objects such as the shown ellipse around a circular point*).

Claim 4:

Navab teaches the method according to claim 3, wherein the graphics object comprises a marker (*the shown ellipse around a circular point is a marker*) that marks the point on the target (*the target is a tumor and the point T is a point on the tumor*).

Claim 5:

Navab teaches the method according to claim 4, wherein the marker has a circular shape, and is centered on the point on the target (*the point T is shown as a circular dot on the target point*).

Claim 6:

Navab teaches the method according to claim 5, wherein the circular shape is a ring (the ellipse is a circular ring because it is circular, see the following dictionary definition of circular found at dictionary.com).

cir·cu·lar
adj.
Of or relating to a circle.
Shaped like or nearly like a circle; round.
Moving in or forming a circle.
Circuitous; roundabout: *took a circular route to the office.*
Using a premise to prove a conclusion that in turn is used to prove the premise: *a circular argument.*
Defining one word in terms of another that is itself defined in terms of the first word.
Addressed or distributed to a large number of persons.
n.
A printed advertisement, directive, or notice intended for mass distribution.

Claim 10:

Navab teaches the method according to claim 1, wherein said aligning step comprises the steps of:

positioning a tip of the instrument on the path (*point f*), at an entry point on a surface of a physical object corresponding to the target (*at column 6 lines 25-28 Navab describes placing point f on or near the patient's body*); and

rotating the instrument around the tip on the entry point (*at column 6 lines 25-28 Navab describes the surgeon changing the direction of the needle*) until the instrument is aligned with the line of sight (*between point f and point*

T) toward the point on the target (*at column 6 lines 25-28 Navab describes the surgeon changing the direction of the needle until the the virtual extension of the needle passes through the image t of the patient*).

Claim 11:

Navab teaches the method according to claim 10, further comprising the step of marking (*placing the needle at point f on the patient's body marks the entry point of the needle*) the entry point on the physical object.

Claim 12:

Navab teaches the method according to claim 11, wherein said entry point is marked by a graphical object (*marking the point with a graphical object because the line between point f and point T is a virtual line and at least its intersection with the outer surface of the patient's body is a graphical object since the intersection of the virtual line and patient's body is visually different than the reset of the displayed outer surface of the patient's body*).

Claim 23:

Navab teaches a method for virtual reality guided instrument positioning (*semiautomatic and automatic*), comprising the steps of: defining a point on an

actual target (*point T is defined by the surgeon*) and an actual path to reach the point on the actual target (*the system determines the path from point f to point T*); tracking a pose of an actual instrument with respect to a pose of the actual target (*the orientation of the needle relative to the target T is determined by the system*); rendering a graphical representation of the actual instrument (*an image representing the needle is shown on the display under the outer surface of the patient*) and the actual target point (*a virtual target point f is displayed on the display*) to obtain a virtual instrument (*the computer generated image of the needle is a virtual instrument*) and a virtual target point (*the computer generated image of the target is a virtual target point*), respectively, the graphical representation being rendered with respect to a virtual viewpoint (*one end of the needle*) from which a virtual line of sight to the virtual target point coincides with a virtual path for the virtual instrument to follow during a positioning of the actual instrument to the point on the actual target (*as the surgeon or system changes the direction of the needle the displayed virtual line indicating the path the needle would follow changes direction accordingly*), the virtual path corresponding to the actual path (*the displayed virtual line corresponds to the actual path the needle will take if it is pressed into the patient's body*); aligning the virtual instrument along the virtual line of sight to the virtual target point to align the actual instrument along the actual path (*the surgeon or the system when in the automatic mode aligns the*

needle along the virtual line of sight to target point T).

Claim 24:

Navab teaches the method according to claim 23, further comprising the step of moving the actual instrument along the actual path towards the point on the actual target, subsequent to said aligning step (*after the surgeon in the semiautomatic step or the system in the automatic step aligns the needle to the path then the needle is moved along the path to the target point T*).

Claim 25:

Navab teaches the method of claim 23, wherein the virtual target point has a circular shape (*see the discussion given for claim 5*).

Claim 26:

Navab teaches the method of claim 25, wherein the circular shape is a ring (*see the discussion given for claim 6*).

Claim 27:

Navab teaches the method of claim 23, wherein the virtual instrument comprises a 3D structure for line of sight alignment (*the system views the needle with 3D coordinates thus the system views the needle as having 3D*

structure for alignment of the needle in the 3D coordinates of the patient's body. The claim is not specific about the 3D structure).

Claim 35:

Navab teaches the method of claim 23, further comprising the step of rendering graphical information about a distance between the actual instrument and the point on the actual target (*the length of the virtual line is equal to the distance between the needle and the target point T, this length is a graphical representation of the distance between the needle and the target point T*).

Claim 40:

Navab teaches the method of claim 23, wherein the graphical representation from the virtual viewpoint is combined with another graphical representation from another virtual viewpoint looking at the virtual path from a side thereof (*see figure 11, column 7 line 61 to column 8 line 1 and column 9 lines 20-37*).

Claim 41:

Navab teaches the method of claim 23, wherein said graphical representation from the virtual viewpoint is combined with an augmented reality view (*the needle represents the real needle about to be inserted into the patient*

and the virtual line and virtual target T are added graphical representations to augment the real world).

7. Claims 1-7, 10-13, 16-27, 35, and 41 are rejected under 35 U.S.C. 102(a) as being anticipated by Benedicte Bascle et al., Needle Placement under X-ray Fluoroscopy using Perspective Invariants, IEEE Workshop on Mathematical methods in Biomedical Image Analysis Proceedings, June 11-12, 2000, pages 46-53.

The Bascle article teaches orienting a needle and displaying an augmented reality view of a patient and needle by displaying a dotted line to indicate the path the needle will take with the current orientation of the needle, see figures 7a and 7b, and displays a circle and a cross hair to indicate the target in the patient, see figure 1.

A detailed analysis of the claims follows.

Claim 1

Bascle teaches a method for augmented reality guided instrument positioning (see figure 1), comprising the steps of: establishing a viewpoint (*the point on the body where the surgeon places the robot's needle is point F*), from which a line of sight to a point on a target (*the surgeon marks the target in the image displayed at the workstation, see figure 1*) defines a path for an instrument to follow during a positioning of the instrument to the point on the target (*the*

straight line path from point F to the target is the path the needle will follow); and aligning the instrument along the line of sight to the point on the target (*the surgeon moves the needle, passive robot arm, or the system moves the needle with an active robot arm to align the needle along the line of sight between point F and the target*).

Claim 2:

Bascle teaches the method according to claim 1, further comprising the step of moving the instrument along the path towards the point on the target, subsequent to said aligning step (*after the needle is aligned to the path that will take it to the target, the needle is moved towards the target as shown in figure 7*).

Claim 3:

Bascle teaches the method according to claim 1, further comprising the step of rendering the target as a graphics object (*figure 1 shows the target as a circle and cross*).

Claim 4:

Bascle teaches the method according to claim 3, wherein the graphics object comprises a marker that marks the point on the target (*see figure 1*).

Claim 5:

Bascle teaches the method according to claim 4, wherein the marker has a circular shape, and is centered on the point on the target (*see figure 1*).

Claim 6:

Bascle teaches the method according to claim 5, wherein the circular shape is a ring (*the circle at the target in figure 1 is a ring*).

Claim 7:

Bascle teaches the method according to claim 1, further comprising the step of marking the path with a plurality of graphical markers (*figure shows the path marked by a dashed line*)

Claim 10:

Bascle teaches the method according to claim 1, wherein said aligning step comprises the steps of: positioning a tip of the instrument on the path (*the surgeon places the tip of the needle at point F which is on the path*), at an entry point on a surface of a physical object (*patient's body*) corresponding to the target (*the surgeon selects the target at the workstation, see figure 1*); and rotating the instrument around the tip on the entry point until the instrument is aligned with the line of sight toward the point on the target (*the surgeon or the system rotates the needle until its path coincides with the path*

from point F to the target).

Claim 11:

Bascle teaches the method according to claim 10, further comprising the step of marking the entry point on the physical object (*the needle is placed at entry point of the patient's body which marks this location, see figures 1 and 7*).

Claim 12:

Bascle teaches the method according to claim 11, wherein said entry point is marked by a graphical object (*the displayed needle guide shown in figure 7 is a graphical object at the entry point because it is an object displayed at the entry point of the needle*).

Claims 23-27, 35, and 41:

Since Bascle is similar to Navab a separate discussion of how these claims are rejected by Bascle is not necessary. Please refer to the discussion of claims 23-27, 35, and 41 given in the rejection based upon the Navab reference.

Claims 13 and 16-22 do not claim the marker is a graphical marker on a virtual instrument corresponding to the actual instrument. Thus these claims are claiming markers on the real instrument or on a virtual instrument.

Claim 13:

Bascle teaches a method for augmented reality guided instrument positioning, comprising the steps of: rendering at least one graphics path guide (*see figure 6*) for indicating a path for an instrument to follow to a target (*see section 3 which describes determining the path the needle will follow based upon the target and a given anatomical landmark*); identifying at least one axis marker on the instrument that marks an axis of the instrument (*the robot arm and needle have an inherent axis*), the axis disposed from a front portion to a back portion of the instrument, the front portion corresponding to the point on the target; and aligning the at least one axis marker with respect to the at least one graphics guide to align the instrument to the path (*once the system has determine the path the needle will take and displayed the path graphically, see figure 6, then the system will align the needle to the path or allow the surgeon to align the needle to the determined point on the patient and the path*).

Claim 16:

Bascle teaches the method according to claim 13, further comprising the step of selecting an existing feature of the instrument to be the at least one axis marker (*the existing feature is the passive or active robot arm*).

Claim 17:

Bascle teaches the method according to claim 13, further comprising the step of designing the instrument to include the at least one axis marker (*robots are designed to have the arms defined by an axis, the term marker can be a physical thing or a virtual thing*).

Claim 18:

Bascle teaches the method according to claim 13, further comprising the step of adding the at least one axis marker to a structure of the instrument (*the needle is added to the robot arm which has the inherent axis*).

Claim 19:

Bascle teaches the method according to claim 13, wherein the at least one axis marker is an elongated member (*the robot arm is an elongated member*).

Claim 20:

Bascle teaches the method according to claim 13, wherein the at least one axis marker has a circular shape, and is centered on the axis of the instrument (*the needle itself is an axis marker and since a needle is hollow it is a circular marker centered on the axis of the needle*).

Claim 21:

Bascle teaches the method according to claim 13, wherein the at least one axis marker is a cross comprised of an intersection of at least two lines (*the term marker is a broad term and is met by the geometric marker robots use to control the move of their arms, robots use rotation about an origin having two perpendicular lines, Cartesian coordinates, to determine the location of the arm and to position the arm*), the intersection being centered on the axis of the instrument (*needle, if the needle is not centered then the position of the needle will have to be offset relative to the arm, thus, centering the arm onto the needle*).

Claim 22:

Bascle teaches the method according to claim 13, wherein the at least one axis marker comprises at least two axis markers for controlling alignment of the instrument along a line of sight (*an axis marker is a broad term and two axis markers for controlling alignment of the instrument is still broad, a first interpretation of what is meant by the claimed axis marker is one axis marker is the robot arm and the other is the needle another interpretation is the sensors in the robot arm for determining the axis are the claimed two axis markers since they do mark an*

axis of the instrument).

Copending Applications

8. A review of US Patent Application Publications reveals at least two of applicants copending applications, 09/818,388 and 09/818,122, having claims which are very close to the claims in this application. The examiner has reviewed the corresponding Patent Application Publications to review the claims, one of which has had no amendments made to the application claims. Applicant is requested to maintain a clear line of demarcation between applicant's copending applications and this application to avoid double patenting issues.

Prior Art

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Andrei State et al., Technologies for Augmented Reality Systems: Realizing Ultrasound-Guided Needle Biopsies, 1996, ACM Press, Proceedings of the 23rd annual conference on Computer Graphics and Interactive Techniques, pages 439-446, teaches a way to obtain proper occlusion relationships between real and virtual objects in augmented reality.

Matthias M. Wloka et al., Resolving Occlusion in Augmented Reality, ACM Press, Proceedings of the 1995 Symposium on Interactive 3D Graphics, pages 5-12, teaches

resolving occlusion in augmented reality by using an algorithm that assigns depth values to each pixel in a pair of stereo video images in near-real-time.

S. Otmane et al., Active Virtual Guides as an Apparatus for Augmented Reality Based Telemanipulation System on the Internet, Simulation Symposium, 2000, April 16-20, 2000, pages 185-191, teaches using line segments, a plan or any arbitrary volume as a virtual guide.

Frank Sauer, et al., Augmented Workspace: designing an AR testbed, Proceedings and ACM International Symposium on Augmented Reality, 2000, October 5-6, 2000, pages 47-53, teaches using a virtual camera to render the video background and placing virtual objects onto the background and in the last paragraph in section 10 describes how the virtual objects occludes the background even when the virtual object is behind the background and states these issues have to be addressed on the way towards real applications.

Sundareswaran et al., U.S. Patent No. 6,330,356, teaches an augmented reality system.

Keller et al., U.S. Patent No. 6,503,195, teaches with regard to figures 8-10b an augmented reality display system where a video of the need outside the patient's body is displayed and a virtual needle showing where the needle is in the patient's body.

Allowable Subject Matter

10. Claims 8, 9, 14, 15, 28-34, and 36-39 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Claims 8-9:

The prior art of record fails to reach or suggest the plurality of graphical markers comprises at least one ring centered on the path.

Claims 28-30:

The prior art of record fails to reach or suggest the virtual instrument's 3D structure comprises a plurality of markers centered on and distributed along an axis of the virtual instrument.

Claims 31-34:

The prior art of record fails to reach or suggest choosing an orientation of the graphical representation around the virtual line of sight according to a pose of a user with respect to the actual target.

Claims 36-39:

The prior art of record fails to reach or suggest the graphical information about the distance is overlaid onto the graphical representation.

Claims 14 and 15:

The prior art of record fails to reach or suggest the step of constructing and rendering the at least one axis marker as graphical marker.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffery A. Brier whose telephone number is (703) 305-4723. The examiner can normally be reached on M-F from 6:30 to 3:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Razavi, can be reached at (703) 305-4713).

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9306 (for Technology Center 2600 only)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 306-0377.

Jeffery A Brier
Primary Examiner
Art Unit 2672